ENERGY IN A NEW ERA OF ARMY INSTALLATIONS

Dale L. Herron

Introduction

Energy represents a critical asset to mission readiness, both today and as installations transform. A safe, reliable energy infrastructure and dependable, long-term energy supply will be paramount to the transformed installations' success in housing, training, and deploying the force. Future Combat Systems may demand new types of energy delivery or support strategies. Further, emerging force protection issues may mandate built-in security measures, both in energy supply and distribution systems and in facilities vulnerable to chemical, biological, and radiological (CBR) threats.

Energy research by the U.S. Army Engineer Research and Development Center (ERDC) will be used in the "Fort Future" modeling and simulation (M&S) process. Transformation of the Army's installations offers major opportunities to make these small "cities" future world-class examples of sustainable, reliable, and energy-efficient facilities.

Background

For the last quarter century, federal energy policy emphasized conservation. During this time, DOD has been challenged with increasingly stringent energy-reduction targets. The Army initiated aggressive programs to meet these requirements and is the only Service that has consistently met or exceeded all energy-reduction goals. More recent DOD energy strategy incorporates sustainable energy design considerations to address life-cycle costs of installation energy investments. Initiatives like privatization of utilities also have taken on increased emphasis. DOD's energy focus is again evolving to now encompass energy security. The following major events triggered this shift of emphasis:

- Energy shortages in the United States during the 2001 heating season and in California that summer caused rolling blackouts and large short-term energy price increases.
- The tragic events of September 11, 2001, and the follow-on anthrax attacks demonstrated both the fragility of the Nation's infrastructure and its impact on personal safety.
- The bankruptcy of Enron, one of the largest energy companies in the world, raised questions about the long-term availability and viability of the nation's energy supplies.

Energy security will clearly be a key aspect of the Nation's energy focus for the foreseeable future. Energy conservation and sustainable design will also continue to be important. Thus, the collective challenge now is to address the need for a safe and reliable energy infrastructure and a dependable, long-term energy supply without losing the successes achieved for energy conservation and sustainable design.

Future Installation Strategies

As the Army installations of today transform, the use of safe, dependable, and environmentally sound energy technology is essential. Army soldiers and their families must live and work in facilities where embedded energy technology maximizes personal and environmental safety and relies on secure sources of

A safe, reliable energy infrastructure and dependable, long-term energy supply will be paramount to the transformed installations' success in housing, training, and deploying the force.

electricity, heating, and cooling energy. Realizing this ambitious energy goal is vital to achieving a sustainable, high quality of life for soldiers.

The first step in achieving this goal is to develop an integrated and strategic planning philosophy for how energy resources will be managed at future installations. Integrated strategic energy planning will require looking beyond the building level, beyond the installation fence, and even beyond the surrounding region to a national, if not global, perspective. Good planning will forecast which energy technologies and strategies will be best integrated into a diversified portfolio of energy supply options. Issues that must be considered include reliability, security, and sustainability from an environmental standpoint. In addition, energy conservation, energy use reduction goals, utility privatization, and utility deregulation will factor into the decisionmaking process. Once policies and plans are established, they will need to become part of the business processes for the Army's new Transformation of Installation Management organization.

Second, future Army installations and individual facilities must be sustainable. Army documents define sustainability as the "design, construction, operation and reuse/removal of the built environment—infrastructure as well as buildings—in an environmentally and energy efficient manner ... meeting the needs of today without compromising the ability of future generations to meet their needs."

Next, secure sources for electricity, heating, and cooling must be identified. An emerging, promising trend for realizing our future electrical energy needs is a shift from purchasing electricity generated by large, company-owned, central-generation plants to small, high-efficiency power sources located at the point of consumption. Distributed electrical energy systems can include solar photovoltaics, fuel cells, gas-fired microturbines, and wind turbines. These systems offer the security and flexibility of onsite electricity generation and are extremely environmentally sustainable.

Finally, the technologies used for heating, cooling, and lighting individual Army buildings must maximize human security, comfort, and productivity while minimizing energy consumption and cost. Promising new heating, ventilation, and air conditioning (HVAC); boiler; chiller; lighting; and direct digital control (DDC) technologies are continually emerging. Future Army facilities must take advantage of these technologies, but only if they can be installed and commissioned to operate correctly when new and throughout the facility life cycle. The best energy technology is of no value if it cannot be properly installed, operated, and maintained.

Some of ERDC's energy research relevant to installation transformation is described below.

Strategic Energy Planning

ERDC is developing a coordinated methodology for installation strategic energy planning (ISEP). The methodology will evaluate short- and long-term utility and energy issues while integrating energy demand and supply issues. When applied to an installation, the ISEP process will result in an investment strategy mixing privatization, utility-company use, third-party initiatives, and programmatic funding vehicles to achieve the desired energy goals. This type of energy investment plan will be integrated with other funding strategies for transforming installations. More information is available at **http://www.cecer.army.mil/SEP/index.htm**.

Stationary fuel cells, which allow onsite electricity production, could give future installations a reliable power source for critical facilities.

SPiRiT And Other Tools

ERDC has developed a rating tool that will identify and measure sustainable principles during construction project planning. The Sustainable Project Rating Tool (SPiRiT) is designed to be an easily understood Microsoft Excel worksheet that will allow self-scoring by building delivery teams either during the charrette process or by an independent panel. The U.S. Army Corps of Engineers requires its designers to use SPiRiT and strive to achieve a "bronze" rating for all future projects. The Army may also require sustainable development on a DD Form 1391, which is used to request all military construction projects within DOD. To view the current version of SPiRiT, go to **http://www.usace.army.mil/inet/usace-docs/eng-tech-ltrs/etl1110-3-491/a-c.pdf**.

Other ERDC-developed tools may be linked to the suite of M&S tools for Fort Future. They include the Renewables and Energy Efficient Planning Program for energy and water analysis and EnergyPlus, which is the Department of Energy's new tool incorporating ERDC's Building Loads Analysis and System Thermodynamics Program.

DOD Fuel Cell Program

Stationary fuel cells, which allow onsite electricity production, could give future installations a reliable power source for critical facilities. They are also nonpolluting. ERDC manages the DOD Phosphoric Acid Fuel Cell (PAFC) Demonstration Program, which has the following objectives:

- Demonstrate fuel cell capabilities in real-world situations,
- Stimulate growth and economies of scale in the fuel cell industry, and
- Determine the role of fuel cells in DOD's long-term energy strategy.

PAFCs were installed at 30 U.S. military bases between 1994 and 1997, making this the largest demonstration of PAFC power plants in the United States. A follow-on program, the Residential Demonstration Program, is targeted at installing 21 small Proton Exchange Membrane fuel cells at DOD sites.

A major success story in fuel cells research was the installation of five fuel cells, connected in parallel to produce 1 megawatt of electricity, which are now the primary source of power for the U.S Postal Service Mail Processing Center in Anchorage, AK. It is the Nation's largest assured-power commercial fuel cell system to date and, for the first time, a fuel cell system is part of an electric utility's grid. This type of application has important implications for providing an uninterrupted power supply at future installations. More information about the DOD Fuel Cell Program is located at **http://www.dodfuelcell.com**.

Interoperable DDC Controls

Emerging "smart" HVAC controls could play an important role in ensuring safe operation and efficient energy use in existing and future facilities. HVAC and other energy systems in modern buildings are typically controlled by state-of-the-art DDCs, which allow building energy systems to be operated in a safe, efficient manner while maximizing occupant comfort and productivity. DDC systems can also be networked together so that multiple buildings can be controlled from a central location, but until recently all the networked systems had to be from the same manufacturer.

As the Army transforms its existing installations to support the Interim and Objective forces, energy is a critical consideration.

Recent developments in the controls industry may have made it possible to interconnect multivendor systems. This is important to the Army because the government's competitive procurement process has, over the years, meant that Army individual DDC systems were purchased from many different manufacturers. Effectively connecting multivendor DDC systems will enable Army installation energy managers to fully implement installation-wide energy security and conservation strategies. An initial demonstration of an interconnected multivendor system is underway at Fort Hood, TX. More information about this project can be obtained at **http://www.cecer.army.mil/td/tips/docs/finney_fthood.pdf**.

HVAC CBR Protection

The recent anthrax attacks at the Hart Senate Office Building and other facilities have demonstrated that HVAC systems can play an important role in minimizing the impact of a CBR attack. As part of the Fort Future effort, ERDC is now developing an HVAC CBR M&S capability to help installation planners and facility designers optimize the level of protection that a facility's HVAC system can provide against a CBR attack. ERDC is also working with individuals associated with the Defense Advanced Research Projects Agency's Immune Buildings Program to develop HVAC hardware with improved CBR protection and improved design methods for implementing CBR protection in facilities.

Conclusion

As the Army transforms its existing installations to support the Interim and Objective forces, energy is a critical consideration. The energy technology associated with the facilities at these new installations must provide soldiers and their families with first-class facilities that maximize safety, comfort, and productivity at minimal energy cost. The shift in the Nation's energy focus from conservation to security, the emerging technology from the energy industry, and the research results from ERDC and other organizations offer the Army tremendous opportunities to make these future installations world-class examples of sustainable, reliable, and secure facilities.

DALE L. HERRON is a Mechanical Engineer at the U.S. Army Engineer Research and Development Center's Construction Engineering Research Laboratory. He received a B.S. degree in physics from Eastern Kentucky University and an M.S. degree in nuclear engineering from the University of Illinois.